



# RFFM4558

## Wi-Fi Front End Module

### Product Overview

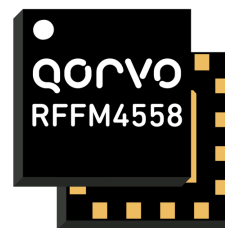
The Qorvo® RFFM4558 is an integrated front end module (FEM) designed for Wi-Fi 802.11ac systems. The compact form factor and integrated matching minimizes layout area in the application.

Performance is focused on optimizing the power amplifier for a 5V supply voltage that conserves power consumption while maintaining the highest linear output power and leading edge throughput. Receive path matches the optimal technologies to maximize Rx sensitivity through noise figure performance that is consistent over a wider variety of conditions.

Integrated die level filtering for 2nd and 3rd harmonics as well as 2.4 GHz rejection for DBDC operation are included.

A DC power detector which has voltage output is integrated as a power control feedback option.

The RFFM4558 integrates a 5 GHz power amplifier (PA), regulator, single pole two throw switch (SP2T), and bypassable low noise amplifier (LNA) into a single device

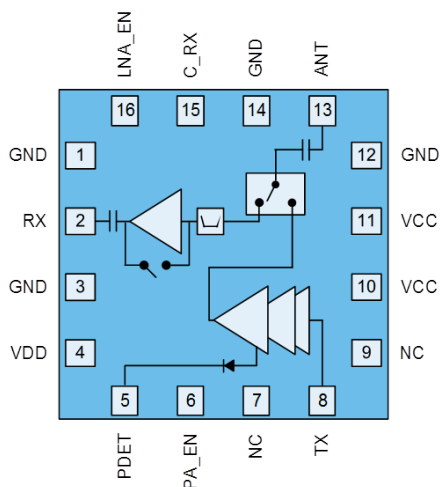


16 Pad 2.5x2.5 mm Laminate Package

### Key Features

- 5180 – 5925 MHz
- $P_{OUT} = +20.5$  dBm MCS9 VHT80 -35dB Dynamic EVM
- $P_{OUT} = +21$  dBm MCS7 HT20/40 -30dB Dynamic EVM
- $P_{OUT} = +24$  dBm MCS0 HT20 Spectral Mask Compliance
- Optimized for +5 V Operation
- 32 dB Tx Gain
- 2.5 dB Noise Figure
- 14 dB Rx Gain & 5 dB Bypass Loss
- 15 dB 2.4 GHz Rejection on Rx Path
- Integrated DC Power Detector

### Functional Block Diagram



Top View

### Applications

- Access Points
- Wireless Routers
- Client Equipment
- Customer Premise Equipment
- Internet of Things

### Ordering Information

Part Number	Description
RFFM4558SB	Sample bag with 5 pieces
RFFM4558SQ	Sample bag with 25 pieces
RFFM4558SR	7" reel with 100 pieces
RFFM4558TR7	7" reel with 2,500 pieces
RFFM4558TR13	13" reel with 10,000 pieces
RFFM4558PCK-410	Assembled Evaluation Board + 5 pcs Sample Bag

## Absolute Maximum Ratings

Parameter	Conditions	Rating
DC Supply Voltage		-0.5 to +6 V
PA Enable Voltage		-0.5 to +6 V
Storage Temperature		-40 to 150 °C
Junction Temperature	MTTF > 1.5x10 <sup>6</sup> hours MTTF > 1.0x10 <sup>6</sup> hours	160 °C 170 °C
RF Input Power at TX	Into 50Ω Load for 802.11a-ac (No Damage), Transmit Mode	+10 dBm
RF Input Power at ANT	(No Damage), Receive LNA On Mode	+10 dBm
RF Input Power at ANT	(No Damage), Receive Bypass Mode	+25 dBm

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. This is an InGaP device designed for high duty cycle applications with T<sub>j</sub>>30 °C over ambient.

## Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Operating Frequency	5180		5925	MHz
Extended Operating Frequency	4900		5925	MHz
Device Voltage (V <sub>CC</sub> & V <sub>DD</sub> )	+4.75	+5	+5.25	V
PA Enable Voltage – High	+2.8	+3.1	V <sub>CC</sub>	V
PA Enable Voltage - Low	0		+0.2	V
T <sub>OPERATING</sub> *	-40		+85	°C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions. \* T<sub>OPERATING</sub> is temperature at the package ground.

## Electrical Specifications

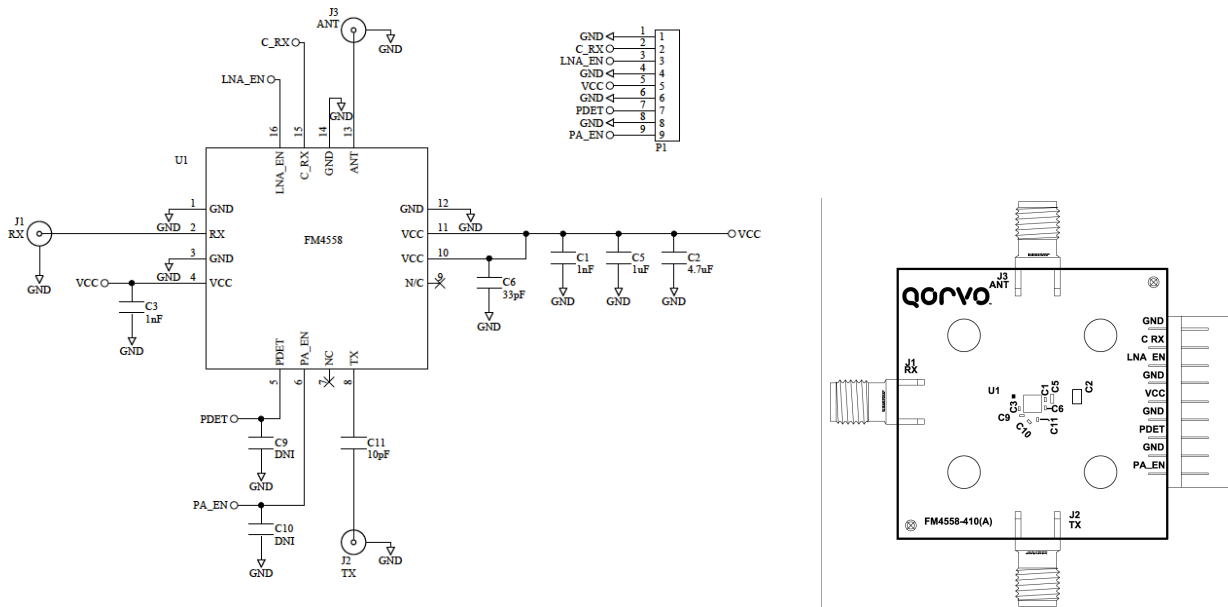
Parameter	Conditions	Min.	Typ.	Max.	Units
<b>TRANSMIT (TX-ANT) MODE</b>	<b>Unless otherwise noted: V<sub>CC</sub>=5V, T=+25°C, PA_EN=High, LNA_EN=Low, C_RX=Low</b>				
11ac VHT80 Output Power	MCS11 1024QAM		18		dBm
Dynamic EVM				-40	dB
11ac VHT160 Output Power	MCS9 256QAM		19		dBm
				-35	dB
11ac VHT80 Output Power	MCS9 256QAM	19	20.5		dBm
Dynamic EVM				-35	dB
11n HT20/40 Output Power	MCS7 64QAM	20	21		dBm
Dynamic EVM				-30	dB
Margin to VHT80 Spectral Mask	P <sub>OUT</sub> = +23 dBm, 11ac MCS0		3	0	dBc
Margin to VHT20 Spectral Mask	P <sub>OUT</sub> = +24 dBm, 11n MCS0		3	0	dBc
Gain		29	32		dB
Gain Flatness	Across any 80 MHz Channel	-0.25		+0.25	dB
Out of Band Gain	f = 1600-1950MHz			-30	
	f = 3300-3800MHz			-5	dB
	f > 7000MHz			10	dB

Parameter	Conditions	Min.	Typ.	Max.	Units
TX Port Return Loss			12		dB
ANT Port Return Loss			7		dB
Quiescent Current	RF Off		100	125	mA
Operating Current	P <sub>OUT</sub> = +20.5 dBm		179	199	mA
	P <sub>OUT</sub> = +24 dBm		240	265	mA
2 <sup>nd</sup> Harmonics	P <sub>OUT</sub> = +24 dBm 802.11a 6 MBps		-35	-30	dBm/MHz
3 <sup>rd</sup> Harmonics	P <sub>OUT</sub> = +24 dBm 802.11a 6 MBps		-45	-35	dBm/MHz
ANT-RX Isolation			35		dB
DC Power Detector Voltage	P <sub>OUT</sub> = +0 dBm		0.22		V
	P <sub>OUT</sub> = +20 dBm		0.47		V
	P <sub>OUT</sub> = +24 dBm		0.67		V
<b>RECEIVE (ANT-RX) LNA ON MODE</b>	<b>Unless otherwise noted: V<sub>CC</sub>=5V, T=+25°C, PA_EN=Low, LNA_EN=High, C_RX=High</b>				
Gain		12.5	14		dB
Gain Flatness	Across any 80 MHz Channel	-0.25		+0.25	dB
Out of Band Gain	f = 2400-2500 MHz		-15		dB
Noise Figure			2.5	3	dB
LNA_OUT Port Return Loss			10		dB
ANT Port Return Loss			5		dB
Input P <sub>1dB</sub>			-5		dBm
Input IP3			+3		dBm
Rx Operating Current			14	20	mA
<b>RECEIVE (ANT-RX) BYPASS MODE</b>	<b>Unless otherwise noted: V<sub>CC</sub>=5V, T=+25°C, PA_EN=Low, LNA_EN=Low, C_RX=High</b>				
Bypass Loss			5		dB
Loss Flatness	Across any 80 MHz Channel	-0.25		+0.25	dB
Out of Band Gain	f = 2400-2500 MHz		-15		dB
RX Port Return Loss			20		dB
ANT Port Return Loss			12		dB
Input P <sub>1dB</sub>			+20		dBm
Input IP3			+25		dBm
<b>GENERAL SPECIFICATIONS</b>	<b>Unless otherwise noted: V<sub>CC</sub>=3.3V, T=+25°C</b>				
FEM Leakage Current			80	200	μA
PA_EN Control Current			1	5	μA
LNA_EN Control Current			150	200	μA
C_RX Control Current			10	20	μA
TX Output P <sub>1dB</sub>	CW		+30		dBm
Ramp ON/OFF Time	10<->90% Ref from Control Voltage to RF Power		200		nS
PA Stability - Output VSWR	CW No Spurious above -41.25dBm/MHz		4:1		
Output Power Range		0		25	dBm
Thermal Resistance, θ <sub>Jc</sub>	Junction to case		30		°C/W

### Logic Truth Table

Mode	PA_EN	LNA_EN	C_RX
Transmit	High	Low	Low
LNA On	Low	High	High
Bypass	Low	Low	High
Standby Mode	Low	Low	Low
Not Supported	All Other States		

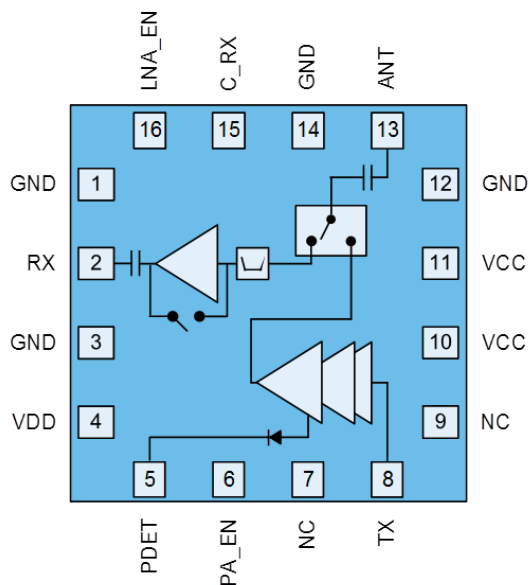
### Evaluation Board Schematic



### Bill of Material

Ref. Des.	Value	Description	Manuf.	Part number
-	-	Printed Circuit Board		
U1	-	5GHz Wi-Fi Front End Module	Qorvo	RFFM4558
C5	1 $\mu$ F	Capacitor, Chip, 10%, 6.3V, X5R, 0402	Taiyo Yuden	RM JMK105 BJ105KV-F
C2	4.7 $\mu$ F	Capacitor, Chip, 10%, 16V, X7R, 0805	AVX	0805YC475KAT2A
C1, C3	1 nF	Capacitor, Chip, 10%, 25V, X7R, 0201		
C11	10 pF	Capacitor, Chip, +/-0.5 pF, 25V, C0G, 0201		
C6	33 pF	Capacitor, Chip, 5%, 25V, C0G, 0201		
C9, C10	-	Do Not Install		

## Pin Configuration and Description

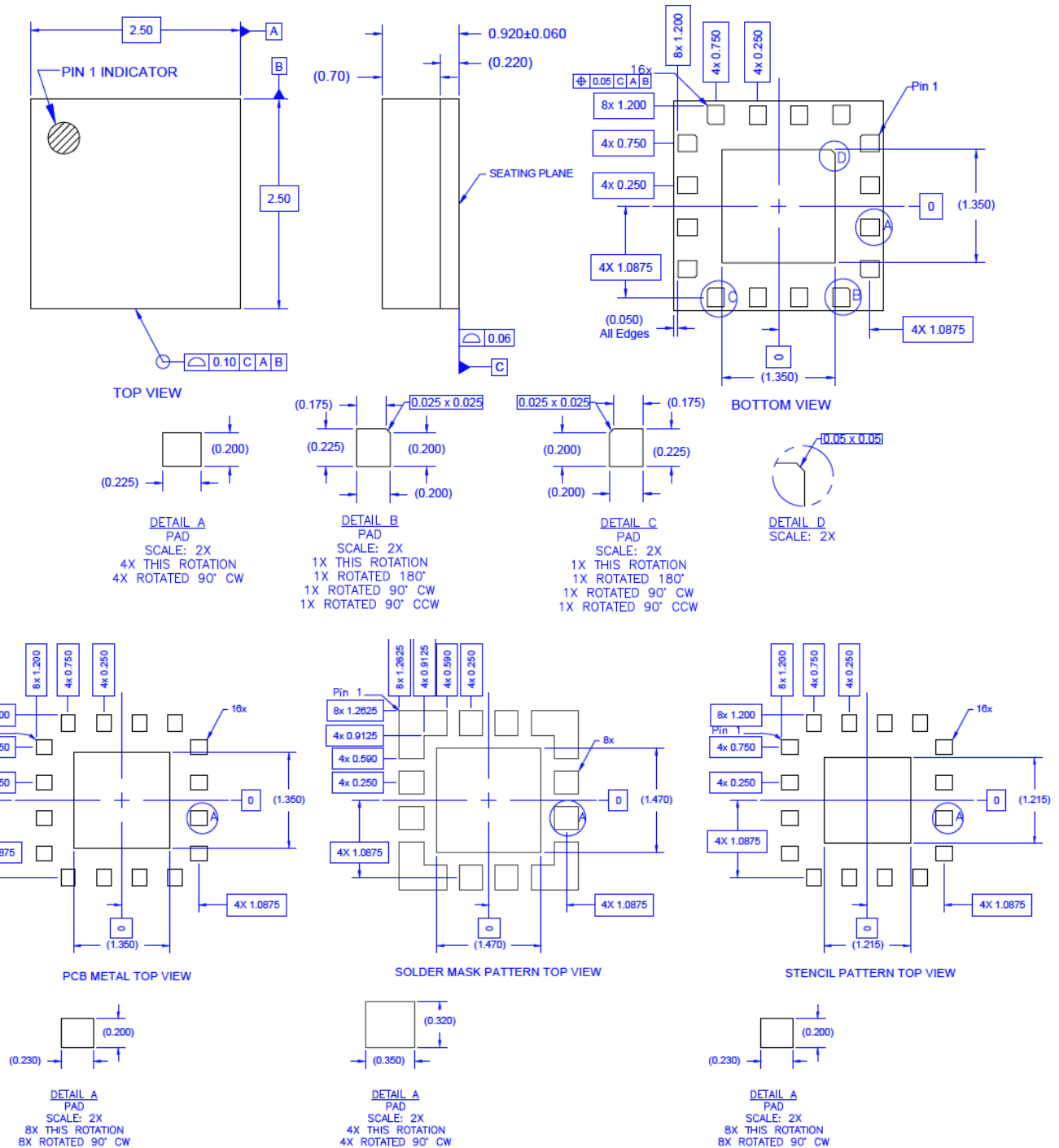


Top View

Pin Number	Label	Description
1	GND	Ground connection.
2	RX	RF output from the low noise amplifier. Internally matched to 50 $\Omega$ and DC blocked.
3	GND	Ground connection.
4	VDD	LNA & regulator supply voltage.
5	PDET	DC power detector. Provides an output voltage proportional to the RF output power level
6	PA_EN	Control pin.
7	NC	No electrical connection.
8	TX	RF input. Internally matched to 50 $\Omega$ and DC shorted.
9	NC	No electrical connection.
10	VCC	Supply voltage
11	VCC	Supply voltage
12	GND	Ground connection.
13	ANT	RF bi-directional antenna port. Internally matched to 50 $\Omega$ and DC blocked.
14	GND	Ground connection.
15	C_RX	Control pin.
16	LNA_EN	Control pin.
Backside Paddle	GND	RF/DC ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint.

## Mechanical Information

### Dimensions and PCB Mounting Pattern



#### Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

## Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1B (500V)	ANSI/ESD/JEDEC JS-001
ESD – Charged Device Model (CDM)	Class C3 (1kV)	JESD22-C101
MSL – Moisture Sensitivity Level	Level 3	IPC/JEDEC J-STD-020



Caution!

ESD sensitive device

## Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package lead plating: Electroless Ni/Electroless Pd/Immersion Au (ENEPIG)

## RoHS Compliance

This part is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C<sub>15</sub>H<sub>12</sub>Br<sub>4</sub>O<sub>2</sub>) Free
- SVHC Free



## Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

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